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16. **Abstract**

Roads have become an integral part of our society, but recently society has begun to realize the ecological impact that roads have on their surroundings. One major effect that roads have on large mammals is creating a barrier to movement of individuals both between and within populations. In an effort to alleviate this problem on a new interstate project, the North Carolina Department of Transportation constructed 2 8 x 8 feet (2.4 x 2.4 m) concrete box culverts on I-26 in Madison County, North Carolina, intended for use by North American black bears (*Ursus americanus*). Black bears have been observed using a variety of crossing structures, and it is not known what type of design best suits their needs. To determine the effectiveness of these crossing structures, each culvert's wildlife activity was recorded by Cuddeback digital still cameras. In addition, digital video data were captured at one of the culverts and sampled to detect wildlife use of the culvert. From these data, detection probabilities and an overall estimate of wildlife use were calculated. Wildlife crossings at other structures along the roadway were also recorded, specifically at culverts built to carry streams under the interstate. Also, still cameras were installed at a few likely crossing locations along the roadway in an attempt to capture black bear presence adjacent to the roadway. Lastly, local residents were solicited for their crossing observations.

Data were collected for at least a year, with some cameras running over a year. During that time 1,715 pictures were taken by the still cameras, and 152 clips of animal activity were collected from the video data. Black bears were detected or reliably reported along I-26 12 times, twice inside Culvert 2. A black bear was detected crossing the road at Culvert 2 4 times, with 1 instance resulting in a bear-fatal vehicle collision.

A GIS model was created to locate areas of possible high black bear movement in Madison County. While the primary goal was to evaluate the location of the culverts and predict bear crossing locations along the I-26 roadway, a secondary goal was to create a tool that could be used to aid in the placement of black bear crossing structures on future roads in the southern Appalachian Mountains. The general concept of the model is that every landscape variable included influences black bear movement a certain degree, either in a positive or negative manner. To determine each variable's weight, a group of black bear researchers with experience in the southern Appalachian Mountains was surveyed. The weight of all variables was added together to determine total bear movement values for each cell of the map.

The map produced by combining the weights for all factors contained values ranging from –317 to 239, with negative values representing areas that impede black bear movement, and positive areas representing areas that promote it. Most of the cells contained positive values (385,973 cells); only 81,066 cells (17.35% of all cells) contained negative values.

Black bear movement locations were collected along I-26 in order to validate the model. Values for the known bear locations were significantly different from the entire set of movement values (Chi square = 25.78, $p = 0.002218$, df = 9), and significantly different from the movement values within 1640.42 feet (500 m) of I-26 (Chi square = 47.12, $p = 3.75\ e^{-7}$, df = 9). Visually comparing the 2 sets of values indicated that most of the area near the interstate deterred bear movement, and bears chose locations with more positive movement values to actually move through.

Bears have been detected in the area of the crossing structures, but have been rarely detected in them. This indicates that they are placed in fairly appropriate locations, which the GIS model confirms. However, wildlife use of crossing structures is thought to be influenced by a myriad of other factors, including human use, vehicle traffic levels, structure design, and wildlife fencing. Two factors can be addressed in an attempt to improve the crossing rates of black bears through the culverts on I-26: human use of the structures and the lack of wildlife fencing. Human use of the culverts could be discouraged by hanging signs and educating the public. Extending wildlife fencing from the culvert entrances could increase bear use of the culverts by funneling bears to the culverts to cross under the interstate.

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